

## Redescription and first record of *Cymbasoma tenue* (Isaac, 1975) (Copepoda: Monstrilloida) in the Mediterranean Sea

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**Abstract.**—Several male specimens of *Cymbasoma tenue* (Isaac, 1975) were found in zooplankton samples collected at Toulon Bay, on the French Mediterranean coast. This copepod has not been recorded since its original description more than 20 years ago, which was based on material collected in the Bristol Channel, England. *Cymbasoma tenue* is here redescribed based on examination of these specimens and of the type material. The taxonomic analysis of these specimens produced new morphological data for the species. This is the first record of the species in the Mediterranean and a latitudinal extension of its known geographical range.

Monstrilloid copepods are parasitic marine crustaceans which are free-living only during the adult and first naupliar stage; their other immature stages are endoparasites of benthic invertebrates such as molluscs and polychaetes (Hartman 1961, Isaac 1975, Grygier 1994a). Huys & Boxshall (1991) recognized three valid genera: *Monstrilla*, *Monstrillopsis* and *Thaumaleus*. However, the genus *Thaumaleus* Krøyer, 1849 is not valid and, except for the type (*T. typicus* Krøyer, 1849), all the species described under this genus should be included under *Cymbasoma* Thompson, 1888 (Grygier 1994a).

From several surface (0–25 m) plankton samples collected in the Bristol Channel area, Isaac (1974) reported 15 species of Monstrilloida, of which six were new. Among the new species, he described *Cymbasoma tenue* (as *Thaumaleus tenuis*) based on three males caught off Gulland Rock, Padstow, Cornwall, England (approx. 50°35'N, 5°30'E). Since its original description more than 20 years ago, this species has not been recorded again, even around the type locality. Most of the known species

of Monstrilloida must be redescribed following to the new upgraded standards on monstrilloid copepod descriptions (Grygier 1994b, Grygier & Ohtsuka 1995). Therefore, Isaac's (1974) brief description of *C. tenue* should be completed with more detail, i.e., descriptions and illustrations of all swimming legs, details of the genital lappets and of the antennular armature, and body proportions.

It should be noted that Grygier (1995) recognized *T. tenuis* as validly proposed in 1974. However, the weak original diagnosis would disallow Isaac's (1974) work as the valid description for this species. Therefore, Isaac (1975) would be then the author and valid date since it was in this work where *T. tenuis* was separated from *T. quadridens* Davis, 1947 by the absence of teeth on the genital lappets and (wrongly) by the absence of hairs on the cephalothorax.

In result of a recent survey (July 1995) of the zooplankton of Toulon Bay on the French Mediterranean coast, several specimens of a monstrilloid copepod were collected and sent to us for identification. The taxonomic analysis of the copepods re-

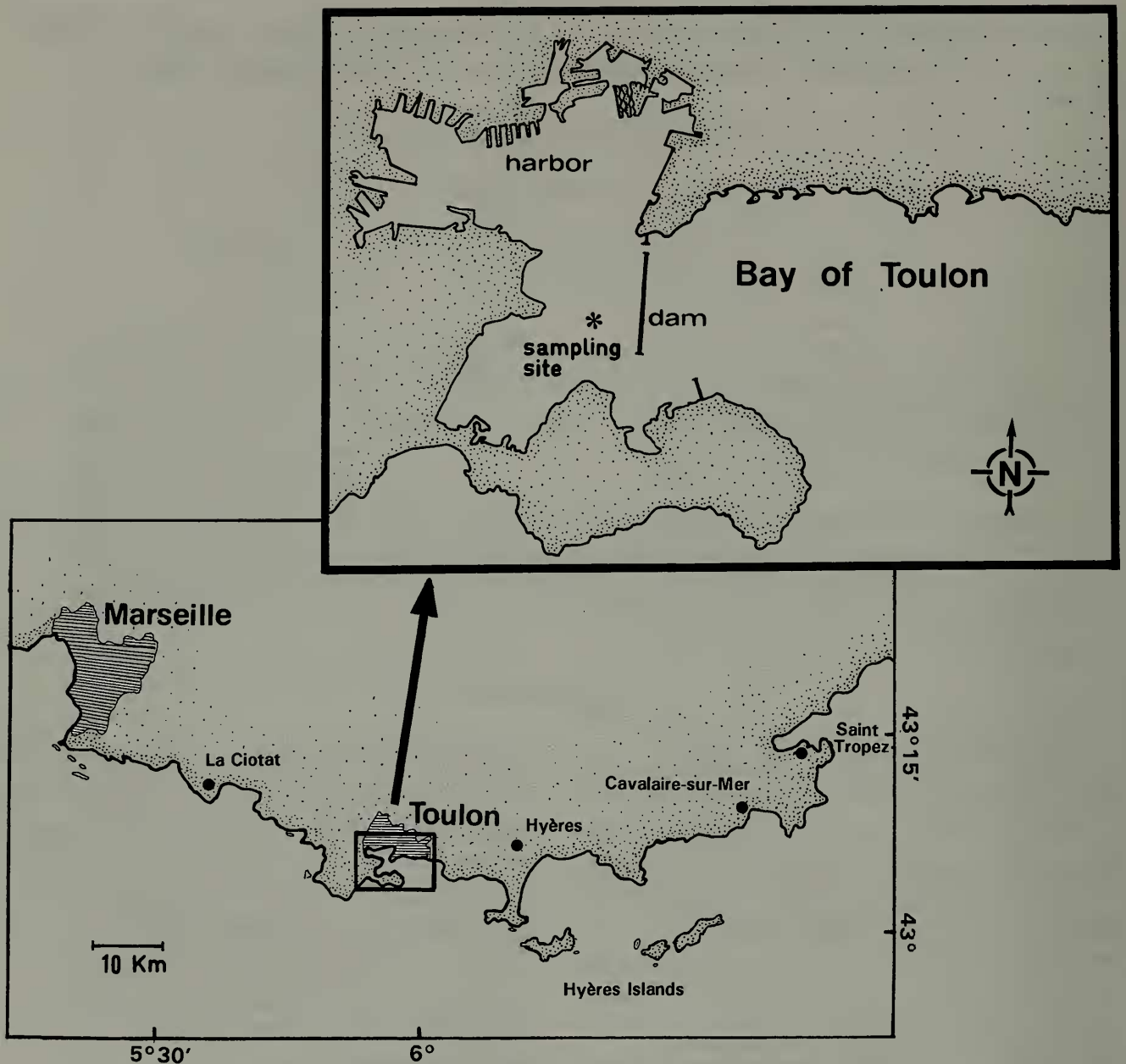


Fig. 1. Study area, showing the locality at which the present specimens were collected.

vealed the presence of three male specimens of *Cymbasoma tenue*, which is here reported for the first time in the Mediterranean, redescribed based on those specimens according to new description standards, and compared with the original description and with the holotype specimen.

*Cymbasoma tenue* (Isaac, 1975)

*Material*.—Holotype, adult male from Gulland Rock, Padstow Cornwall, England, deposited at the British Museum of Natural History (BMNH 1972.11.1.7). Three adult males from Toulon Bay, France, sent for de-

posit to the National Museum of Natural History, Smithsonian Institution, were lost in the mail. An additional male specimen was cataloged as USNM 278220.

*New locality and habitat*.—Toulon Bay (43°5'N, 6°0'E) is located on the French coast of the Mediterranean Sea (northwestern) (Fig. 1). The continental shelf of the area is narrow, with a mean slope of 2.4% (Poidenot 1993). Zooplankton was collected on 11 July 1995 by vertical hauls (0–22 m) with a standard conical plankton net (0.09 mm mesh size) and preserved in buffered 5% seawater formalin. The monstrial-

loid copepods were transferred to a 70% ethanol solution. The salinity varied between 33.7 and 33.9 PSU, while the mean water temperature was 22.8°C.

*Description.*—Male. Mean body length of three analyzed specimens 1.15 mm, measured in dorsal view from anterior end of cephalothorax to posterior edge of anal somite. Cephalothorax 0.54 mm long, representing almost 50% of total body length (Fig. 2A). Oral papilla located less than 30% of way back along ventral surface of cephalothorax (Fig. 2B). Cephalic region, abruptly broadening anterior to oral papilla, posterior part of cephalothorax gradually broadening to same width. Dorsal ocelli present, pigment cups small and widely separated, poorly developed, almost unpigmented, round in dorsal view. Cephalic region in dorsal view with one central cuticular protuberance on forehead between pigment cups (arrow in Fig. 2B) and paired small sensilla on lateral portions of same area. Two strongly chitinized, rounded cuticular processes located posterior to pigmented region of ocelli. Other cuticular features including two concavities and faint ridges on frontal region between oral papilla and antennular base (Fig. 2C).

Mean antennular length of four specimens 0.39 mm, close to 37% of total body length, and *ca.* 75% as long as cephalothorax. Four-segmented, each segment armed with 0-I; 1-V; 2-I; 8-VIII+aes setae (in Arabic numbers), spines (in Roman numbers), and aesthetascs (aes), respectively. Distal antennular segment incompletely fused with third segment, with three subequal, dichotomously branched setae aligned near outer distal end. Following basic setal nomenclature of Grygier & Ohtsuka (1995) for female monstrilloid copepod antennules, two aesthetascs (4aes, 6aes) and three setae (IVv, Vv, Vm) absent in the studied specimens. Length ratio of antennular segments: 20.8: 22.9: 33.3: 22.9 = 100 (Fig. 2D). First pedigerous thoracic somite incorporated into cephalothorax. This and succeeding three pedigers each bearing well developed

swimming legs, all with 3-segmented rami and with same armament pattern, except for leg 1 exopod (Fig. 3A–D). Legs 2 and 3 slightly larger (*ca.* 7%) than 1 and 4; exopods longer than endopods in all cases. Coxae of each pair unarmed, joined by intercoxal sclerite slightly longer than wide. Basis separated from coxa posteriorly by diagonal articulation. Outer margin of basis of swimming legs 1, 2 and 4 with a small, thin seta; seta on leg 3 *ca.* 3 times larger and thicker than in the other legs, plumose. These setae were lost in two specimens. Outer distal corner of first and third exopodal segments of legs 1–4 each with short, spinelike seta, about one-ninth as long as segment. All natatory setae lightly and biserially plumose except for seta on outer distal corner of third exopodal segments of legs 1–4, this being plumose along inner side, but bearing row of small denticles along outer margin (Fig. 3A, C, D). Armament formula of swimming legs as:

	Basis	Exopod	Endopod
Leg 1	0-1	I-0; 0-1; I, 2, 2	0-1; 0-1; 1, 2, 2
Legs 2–4	0-1	I-0; 0-1; I, 2, 3	0-1; 0-1; 1, 2, 2

As usual in males, fifth leg absent. Pair of digitiform genital lappets present on genital somite, both appearing elongated, strongly divergent, distally flattened, and almost reaching half-way down last—anal—somite (Fig. 3F). Small, subtriangular protuberance present at medial base of each genital lappet (Fig. 3F).

Urosome consisting of four segments: fifth pedigerous somite (with no appendages), genital somite (with genital complex) and two free somites. From dorsal view, genital somite about as long as preanal urosomites, anterior half expanded ventrally. Anal somite being the longest and widest of the urosome. Ratio of lengths of genital somite and two free posterior somites being: 34.6: 23: 40 = 100 (Fig. 3E).

Furcal rami nearly quadrate, with terminal margin 45% wider than proximal. Approximately 1.2 times wider than long, with three well developed terminal setae of

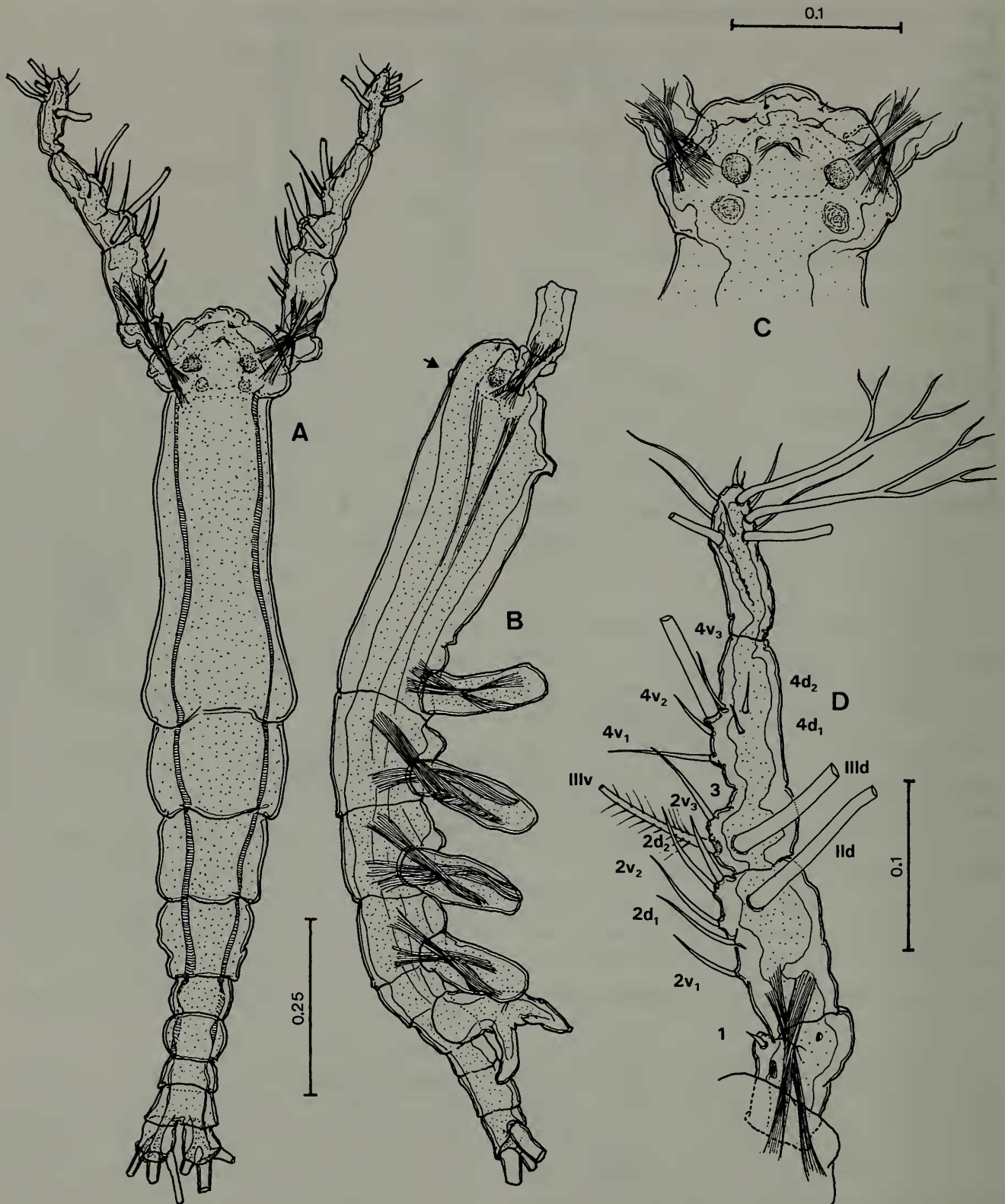


Fig. 2. *Cymbasoma tenue* adult male. A) habitus, dorsal; B) habitus, lateral. C) cephalic region, dorsal. D) right antennule, dorsal. Scales in mm.

which middle one slightly longer than other two, these being equal in length and thickness.

*Female:* unknown

*Discussion.*—Previous to this record of

*C. tenue*, several other species of *Cymbasoma* have been reported from the Mediterranean (Isaac 1975, Razouls & Durand 1991): *C. claparedii* (Giesbrecht, 1892) (females only, male unknown), *C. longispi-*

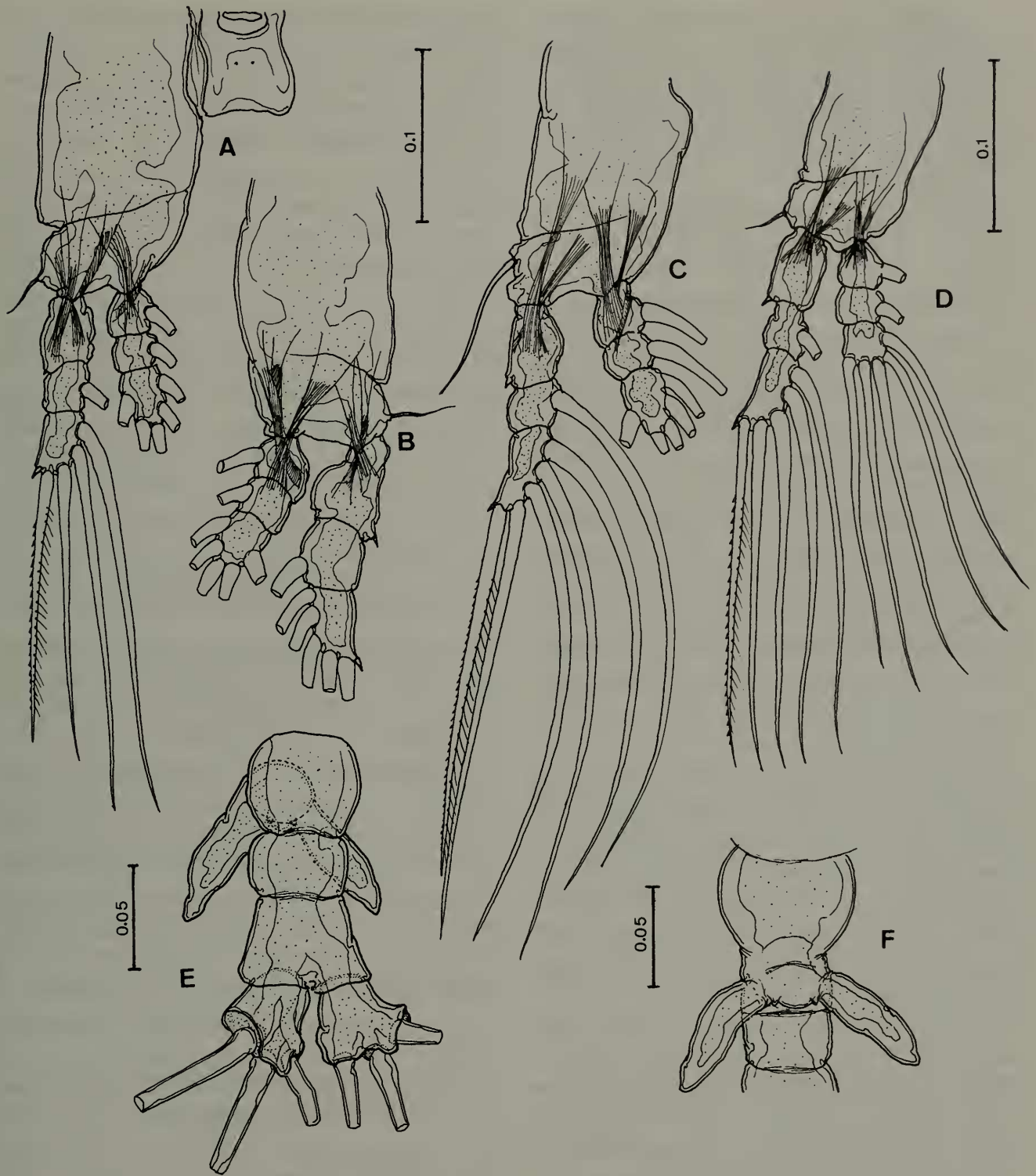


Fig. 3. *Cymbasoma tenue* adult male. A) first leg, posterior; B) second leg, anterior. C) third leg, posterior; D) fourth leg, posterior; E) urosome and furcal rami, dorsal; F) genital complex, genital lappets, ventral. Scales in mm.

*nosum* (Bourne, 1890), *C. rigidum* Thompson, 1888a, and *C. reticulatum* (Giesbrecht, 1892) (females only, male unknown), *C. thompsoni* (Giesbrecht, 1892), and *C. tumorifrons* (Isaac, 1975). *Cymbasoma herdmani* Thompson 1888b, recorded from off Malta, is considered a synonym of

*Monstrilla anglica* Lubbock, while *C. clapedii*, recorded from Naples, is probably a synonym of *C. rigidum* (see Sars 1921). There are some additional undetermined local records of monstrilloids in the Mediterranean, such as a *Thaumaleus* sp from off Capri, reported by LoBianco (1903), or

monstrilloids caught from Livorno, Rapallo and San Remo on the Italian coast (Basso et al. 1980). The most recent records of *Cymbasoma* species in Mediterranean waters are those of Lakkis (1984), who found *C. longispinosum* and *C. rigidum* in the Levantine Basin, and Citarella (1986), who found *C. longispinosum* off Marseilles, France.

By direct comparison with the holotype, the male specimens from the Mediterranean easily matched *Cymbasoma tenue* in the general aspect of the body, the general structure of the genital lappets—with a low protuberance between them—and the armature of the antennules (Isaac 1974, 1975). The female of this species remains unknown. This species is morphologically similar to *C. pallidum* (Isaac 1974); males of the two species differ mainly in their size, body proportions and in the structure of the genital lappets, which are very much longer and more slender in *C. pallidum* (Isaac 1975).

The Mediterranean specimens show precise similarities but also some differences with respect to the holotype and the original descriptions and illustrations of *C. tenue*. It is noteworthy to mention that the cephalothorax of the holotype specimen is distorted, some antennular setae are missing, and one rami of the fourth leg is incomplete. The body length is equal in both cases (around 1.1 mm; one of our specimens is slightly larger: 1.24 mm). In both cases the cephalothorax is almost 50% of total body length, the oral papilla is located less than 30% of way back along the ventral surface of the cephalothorax, the antennules are 75% as long as the cephalothorax, and the length ratio of the antennular segments is similar. As in the type material, the Mediterranean specimens bear four-segmented antennules; close to midlength of the third segment there is a constriction which may be the result of an incomplete segmental separation. In monstrilloid copepods the degree of fusion of the antennular segments exhibits a wide range of variation, from a

sharp separation (as in the males of *C. longispinosum*, *C. quadridens* or *C. zetlandicum* (T. Scott, 1904)) to an almost complete fusion of the segments (as in *Monstrilla elongata* Suárez-Morales, 1994). The shape of the head is identical in both cases; the cuticular features of the cephalic region could not be compared since they were not originally illustrated.

We found differences between the antennules of the studied specimens and those from the original description. Isaac (1974) reported no bifurcating antennular setae. However, these branched setae are present in the holotype, and are clearly present in our specimens (three along the outer margin of the terminal segment in both cases). Branched and unbranched setae have been observed in the same population of male *Monstrilla reidae* Suárez-Morales, 1992 (pers. obs.), and has been used as a specific diagnostic feature by Grygier & Ohtsuka (1995) for female *Monstrilla*. However, this is not the case of *C. tenue*.

Considering that the setation pattern proposed by Grygier & Ohtsuka (1995) has been designed for female antennules, only the proximal armament will be compared in our male specimens since there are sexual differences in the monstrilloid antennular setation pattern. In the original description (Isaac 1974), the spine on the inner side of the first antennular segment (1) was not illustrated or mentioned. However, a long, slender seta is present in the holotype specimen, it is 2.5 times longer than the spine-like structure described for the Mediterranean material. Setae  $2v_1$ – $2v_3$  and  $2d_1$  and  $2d_2$  are present in the holotype specimen and in our material. Seta IId, not illustrated by Isaac (1974), is present only on the left antennule in the holotype. Setae  $4d_1$  and  $4d_2$  are 50% longer in the holotype than in our specimens, almost reaching the distal margin of the same segment. The single terminal spine on the last antennular segment is twice longer in the holotype than in the Mediterranean specimens. On the other hand, none of the setae or aesthetascs miss-

ing in our specimens according to Grygier and Ohtsuka's (1995) pattern, were illustrated in the original description, which supports the idea that the present analysis completes the antennular armature set of the male of this species.

The urosomal somites were illustrated by Isaac (1974); the anal somite appears very thin and long, with approximate relative lengths of these somites being (from the figure): 24: 17: 57 = 100. However, proportions of the holotype specimens and those of the Mediterranean differ from Isaac's illustrations (holotype, 35: 23: 45 = 100; our specimens, 34.6: 23: 40 = 100).

Isaac (1974) illustrated only the fourth swimming leg. All the swimming legs of *C. tenue* are here described and illustrated for the first time. The genital lappets in both cases are identical in most respects; however, the Mediterranean specimens show a low, subtriangular protuberance in the base of each genital lappet, a structure which was not previously described for the species. Differences at this level (genital complex) are taxonomically relevant (McAlice 1985). This is a relevant new structure to be considered useful for the diagnosis and recognition of this species since several species of the genus *Cymbasoma* share this type of male genital lappets (*C. pallidum*, *C. tumorifrons* Isaac, *C. similirostratum* Isaac, and *C. quadridens*).

Key for the Mediterranean species of *Cymbasoma* (males)

- 1A. With constriction on anal somite, genital lappets with serrated posterior margins . . . . . *C. rigidum*
- 1B. Without constriction on anal somite, genital lappets not serrated . . . . . 2
- 2A. Genital lappets extended more than 1/3 of anal somite . . . . . 3
- 2B. Genital lappets short, barely reaching anterior margin of preanal somite . . . . . *C. longispinosum*
- 3A. Genital lappets long, tapering distally and ending in sharp tips . . *C. tumorifrons*
- 3B. Genital lappets distally rounded . . . . . 4

- 4A. With subtriangular protuberances on basal portion of each lappet. Cephalic portion wider than body . . . . . *C. tenue*
- 4B. Without such protuberances. Cephalic portion not wider than body . . . . . *C. thompsoni*

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